CERES Data Management Team Minutes for 03/10/2004

• **Schedule**:

03/29-04/02/04 CERES Science Team Meeting jointly with GERB at NCAR
04/15/2004 IOC replacement ceresarchive

Ongoing Activities:

- B1250 Rehab (Planned completion ~03/2005)

Priority Items:

- Development and Processing Priorities are based on Program commitments in early FY2004
    - Preparations for Data Products review at NHQ/Y (February, 2004 – estimated)
    - Preparations for STM in March, 2004
    - Data Products Needed
        - 2 years (3/00 - 2/02) of Terra Edition2A SSF (COMPLETE)
        - 2 years (3/00 - 2/02) of Terra Edition2A SRBAVG
        - 4 seasonal months (crosstrack) Edition2A CRS (PROBABLY OK FOR STM)
        - Aqua Edition2 BDS/ERBElike through 8/03 (COMPLETE)
        - 1 month of Aqua Beta2 SSF (COMPLETE)
        - Remaining 8 months of (crosstrack) Edition2A CRS (to complete 2001) (MAY BE STARTED STM)
        - 1 year (3/02 - 2/03) of Terra Edition2A SSF (PARTIAL FOR STM)
        - 1 year (3/02 - 2/03) of Terra Edition2A SRBAVG

• **Announcements**:.

- NPOESS Status Report after DMT Meeting
- Maintenance stand down for April does not have sufficient justification to warrant. Further review is required.

- **Standing Committee Reports**

(These notes supplement the reports posted by the various Committee's on the CERES DMT status page.)

Agenda	Committee	Responsibility	Updated	Status/Issues
1.00	**ASDC/ECS Interfaces**	Hopson/Sorlie/ Link	03/10/04	D.Cordner reported that the ASDC needs to upgrade IRIX to maintain security patches. A separate meeting will be held on this subject on 03/15/04. C.Harris reported that a considerable number of files from GSFC had been corrupted by a defective router over the past several months. Data for observational dates over a year have been effected, including MODIS and GMAO. Scheduled maintenance will be conducted on various systems will occur on 03/15/04.
2.00	**SCF**	Flippo	03/10/04	No platform for testing the new IRIX is available.
3.00	**Toolkit**	Flippo	03/10/04	Compilation on the Macintosh G5 has been difficult in FORTRAN90, although FORTRAN77 compiled with no problems. Further investigation is ongoing.
4.00	**System Issues**			
4.01	Processing Strategy	Geier	03/10/04	The delivery and production schedules limit the window of opportunity for an IRIX upgrade to a very brief period starting 05/10/04 for the SCF and 06/07/04 for the ASDC without interfering with production. Further details will be provided at the upgrade meeting.
4.02	Systems Engineering Committee	Nolan/Sorlie/ Hopson/ Ayers/Cooper	03/10/04	The SEC provided estimates of the QA filespace requirements to M.Little. It was confirmed with the ASDC that it is feasible to move these files into a storage facility at the SCF. These files do not exist in the ASDC archive, but do not require high availability.
4.03	Configuration Management & SCCR/DCCR Review	Ayers/Franklin/ Saunders	03/10/04	Several SCCRs were reviewed and approved.

	Working Group Status			(See posted Subsystem Status Reports)
5.01	**External Interfaces-** Instrument	Spence	03/10/04	No new operations are planned.
5.02	**External Interfaces-** Data Sources	Sorlie	03/10/04	Problems with data from GSFC have been identified due to the bad router described above. Further investigation is in progress.
5.03	**External Interfaces-** Customers	Detweiler	03/10/04	Read packages for 6 products have been updated.
5.04	Simulator	Chapman	04/09/03	No additional information was provided.
5.05	Visualization/ Validation Tools	Lee	01/15/03	No additional information was provided.
5.06	Instrument (SS 1)	Cooper/ Hess/Spence/ Szewczyk/Filer	03/10/04	Work is ongoing regarding the 5W net radiance issue being discovered in TISA.
5.07	ERBE-like (SS 2, SS3)	Kizer/Robbins Walikainen/	03/10/04	No additional information was provided.
5.08	Clouds (SS 4.1, 4.2, 4.3)	Sun-Mack	03/10/04	The CloudVis Web Viewer is to be used as a debugging tool.
5.09	Clouds (SS 4.4)	Miller	03/10/04	Bad MODIS granules have been replaced and are being re-run.
5.10	Inversion (SS 4.5, 4.6)	Nolan	03/10/04	No additional information was provided.
5.11	SARB (SS 5.0, 7.2, 12.0)	Coleman	03/10/04	No additional information was provided.
5.12	**TISA-**(SS 6.0, 9.0) Gridding	Raju	03/10/04	No additional information was provided.
5.13	**TISA-** (SS 11.0) GGEO	Stassi	03/10/04	No additional information was provided.
5.14	**TISA-**(SS10.0, 8.0) Averaging	Nguyen	03/10/04	Delivery is on track.
5.15	**CERESlib**	Stassi	03/10/04	No additional information was provided.

Making CERES Algorithms Open Source

- Objectives & Motivation
- Strategy
- Current Status
- Observations

February 18, 2004

Michael.M.Little@nasa.gov

757-864-6837

Objectives & Motivation
Converting CERES From SGI to Open-Source Processing

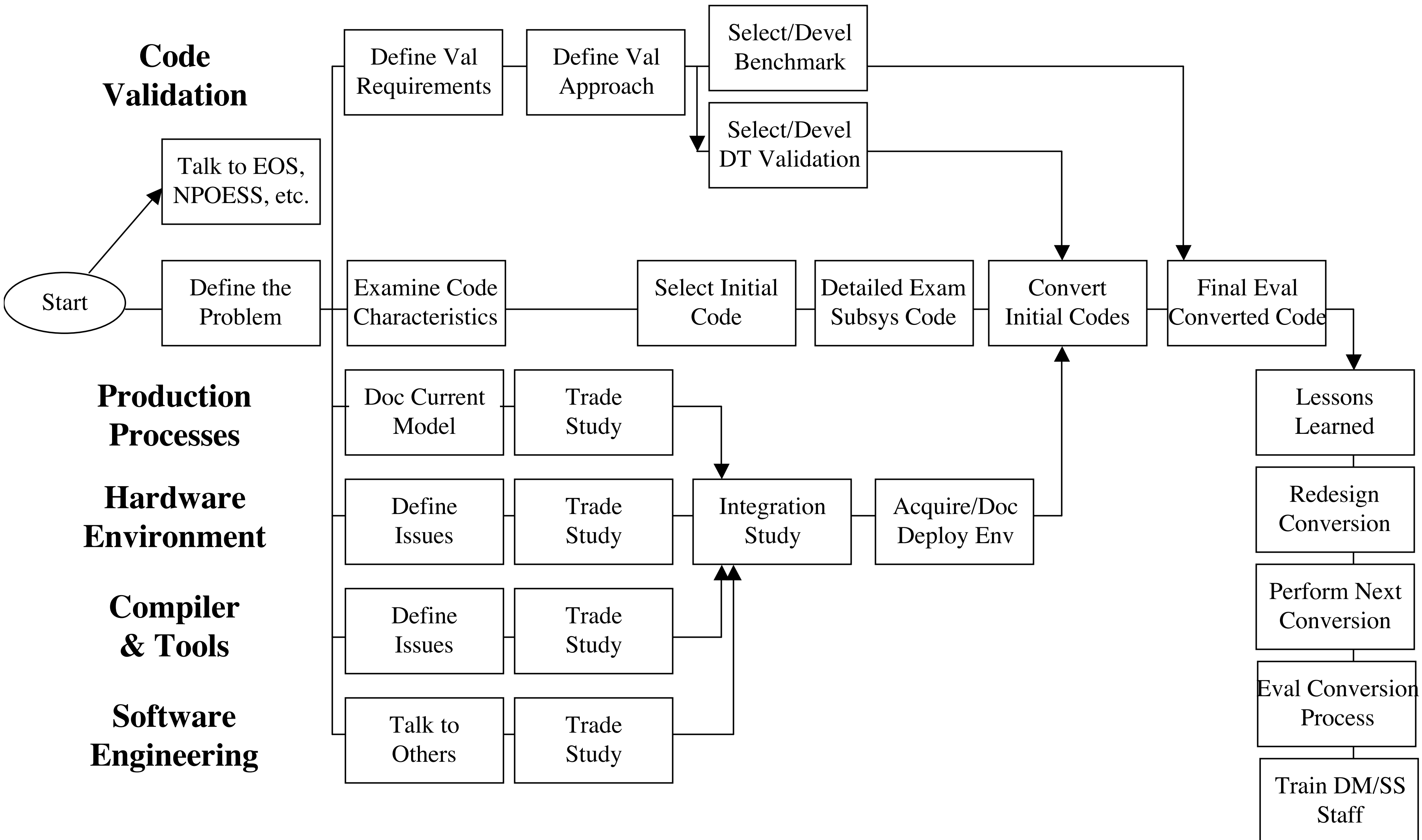
- Objectives
  - Reduce cost of out-year processing for EOS Phase 2 by eliminating dependence on pricey SGI acquisition and maintenance
  - Improve feasibility of deriving new data products from CERES algorithms and codes
  - Make CERES instruments more attractive to fly on other spacecraft
- Additional Motivations
  - Reduce dependence of future researchers on specific hardware processing environment
  - Ensure CERES-derived data products are climate data record quality independent of production platform
  - Understand code structure enough to evaluate different processing strategies

Overall Strategy
Converting CERES From SGI to Open-Source Processing

Admire the Problem → Perform Pilot Conversion → Validate Conversion Process → Convert Remaining Subsystems

- Design Conversion Process (2/1/04 to 1/31/05) (.75FTE)
  - Conduct trade studies to define new processing environment
    - Production strategy
    - Hardware environment
    - Compilers and tools
    - Software engineering processes
    - Validation processes
  - Survey other SGI convertees for insights into code conversion
  - Convert an initial subsystem to design conversion process
    - Not to interfere with existing subsystem development
- Test & Evaluate Conversion Process on Second Subsystem
  - Train scientists and data management personnel in new environment
  - Ensure adequacy of documentation

Strategy - Initial Phase
Converting CERES From SGI to Open-Source Processing



Status: February 17, 2004
Converting CERES From SGI to Open-Source Processing

- Environment Selection
  - Hardware: LINUX
    - Requirements defined, trade study in progress by DAAC
  - Compiler
    - Requirements defined, trade study in progress by DAAC
  - Production Strategy
    - Review of Code characteristics started 02/16/02
    - Re-processing may present opportunities for efficiency or reduced clock-time
    - Doesn't seem to be a way around need for Proximity to the data
  - SWE
    - Data Collection in Progress
- Initial Code Selection: SARB Subsystem
  - High, early impact in cost reduction
    - SARB is a high volume processing load
  - Relatively simple system design with good rigor
    - Few authors
  - Code Inspection to start with next SARB delivery
  - CERES to CERES instrument, not including NPOESS changes

Observations
Converting CERES From SGI to Open-Source Processing

- Converting code to get it to run is easy
  - Converting code to get the same results is NOT easy
  - Converting code to get the same results EFFICIENTLY is the real task
  - Must also keep original developers in the loop to ensure continued maintenance
- 64-bit processing
  - Immature; commodity market has not yet arrived
  - Can we do 32-bit now and convert again, trivially, later?
- Compilers
  - gnu is less mature than CERES needs right now
  - 64-bit is only available in a few cases
  - Assessing what you can do with the right flags is important
- Additional conversion personnel would be useful
  - Once the initial subsystem is complete, could apply 2FTE
- Raytheon NPOESS Software Engineering Standards
  - CERES would like to include these in the SWE Process

Backup Charts
Converting CERES From SGI to Open-Source Processing

Environment Selection Issues
Converting CERES From SGI to Open-Source Processing

- Hardware
  - Convert to an environment which the Langley DAAC can support
  - Expect a selection by DAAC within 2 months
- Compilers
  - 64-bit vs. 32-bit
  - Big endian vs. little endian conversion
  - Must produce scientifically identical data products
  - Must run on SGI, Intel, IBM960 environments
    - Bonus: Solaris and Macintosh OS X
  - Expect a selection by DAAC within 2 months

Subsystem Characteristics
Converting CERES From SGI to Open-Source Processing

SubSys ID No	Subsys Name	Source Lines W/ comments	Source Lines W/o comments	Script Lines	MCF Lines	Source Code (B)	Scripts (B)	MCF (B)
1.0	Instrument	170,502	127,657	32,300	6,651	6,814,569	1,375,801	214,927
2.0, 3.0	ERBE-like	104,745	54,882	21,885	11,200	3,672,212	1,009,325	361984
4.1-4.4	Clouds	458,109	355,657	25,492	0	15,484,245	1,030,404	0
4.5, 4.6	Inversion	110342	68,330	11,003	4,703	3,755,090	602,605	147,361
5.0	SARB	31,067	17,152	5037	2851	1,073,531	202,096	90,591
7.2	SynSARB	56,347	37,009	1,395	700	2,434,349	57,592	22,620
12.0	MOA	21,418	10,028	1,802	700	764,012	74,867	22,624
6.0, 9.0	TISA	63,933	45,093	14,329	4,218	2,311,102	428,688	136,387
7.1, 8.0, 10.0	TISA	88,554	60,188	4,842	7,000	2,985,887	178,300	226,236
11.0	TISA	124,796	96,231	17,272	1,400	4,198,572	5,294,194	45,248
	CERESlib	125,903	86,711	9,749	1,374	3,958,214	238,526	44,194
TOTAL		1,355,716	958,938	145,106	40,797	47,451,783	10,492,398	1,312,172

Data collected 10/15/03

ERBS processing trade study status

Maria Caponi
ERBS OAT
Feb. 18, 2004

Overview

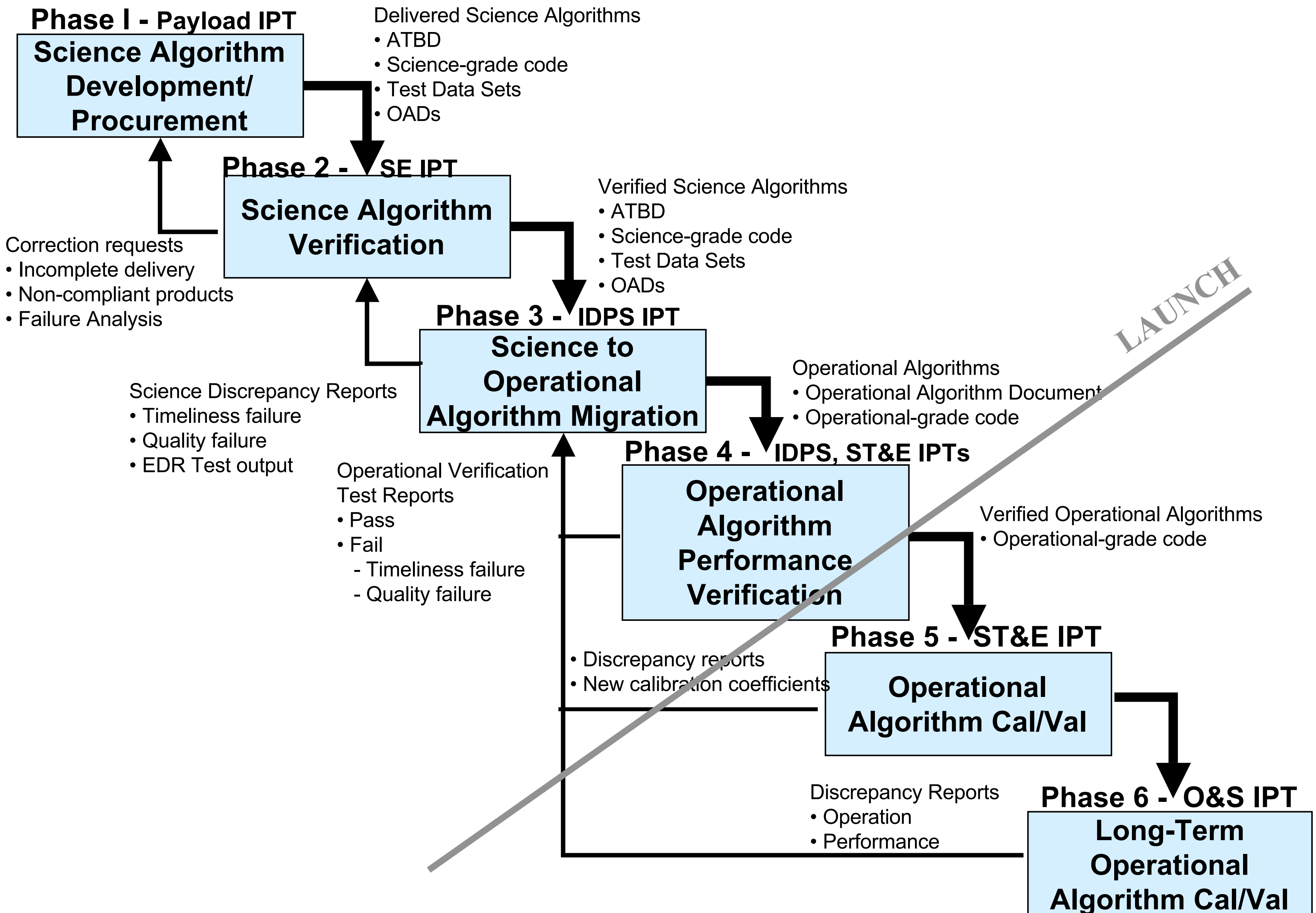
- NGST NPOESS Algorithm Process
  - Development to Operation
  - IDPS characteristics
- ERBS algorithms characteristics
- Trade Study
  - Evaluation criteria
  - Trade off options
  - Inputs/Outputs to completion

Algorithm Phases
Development to Operation

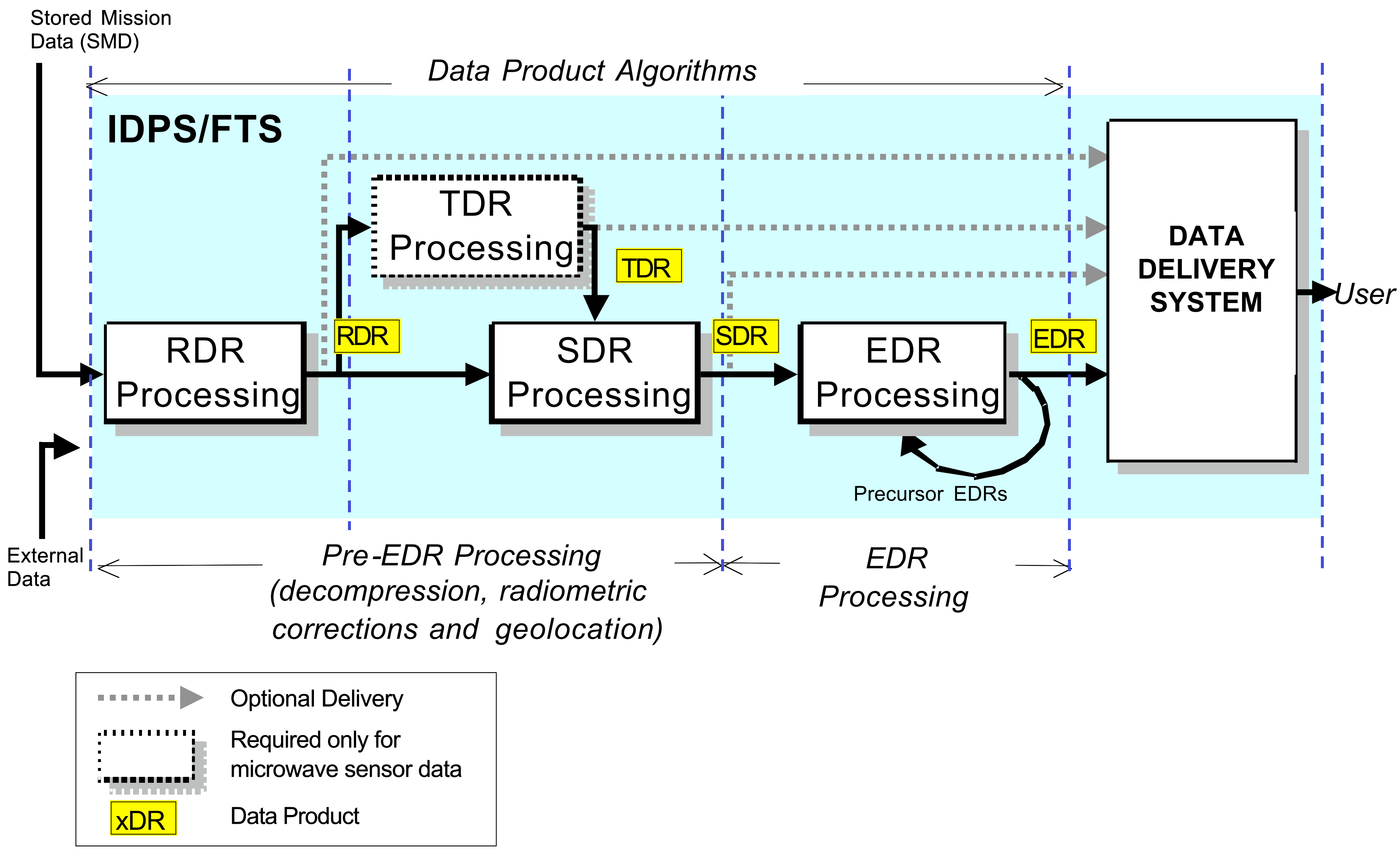
SDR and EDR generation algorithms are developed in several phases

- Science grade code : developed and delivered by sensor vendor except for ERBS ("leverage code")
- Science grade code is tested and verified (Wicket 1 with developer data, Wicket 2 with extended data if needed)
- Verified science grade code is delivered to IDPS for conversion to operational
- IDPS (Aurora) converts science grade code to operational. Includes separation of processing from I/O in Data Management System (DMS); integration and testing and performance verification
- ST&E performs a test of the system that includes pre-launch and post launch calibration and validation: sensor characterization data bases for calibration coefficients, integrated system (RDR to EDR including ancillary and auxiliary data) operational performance verification
- The verified operational algorithm is distributed to the Centrals IDPS (AFWA, FINMA, NAVO, NOAA/NESDIS) for xDR processing and data distribution
- O&S takes over for the long term algorithm cal/validation and maintenance

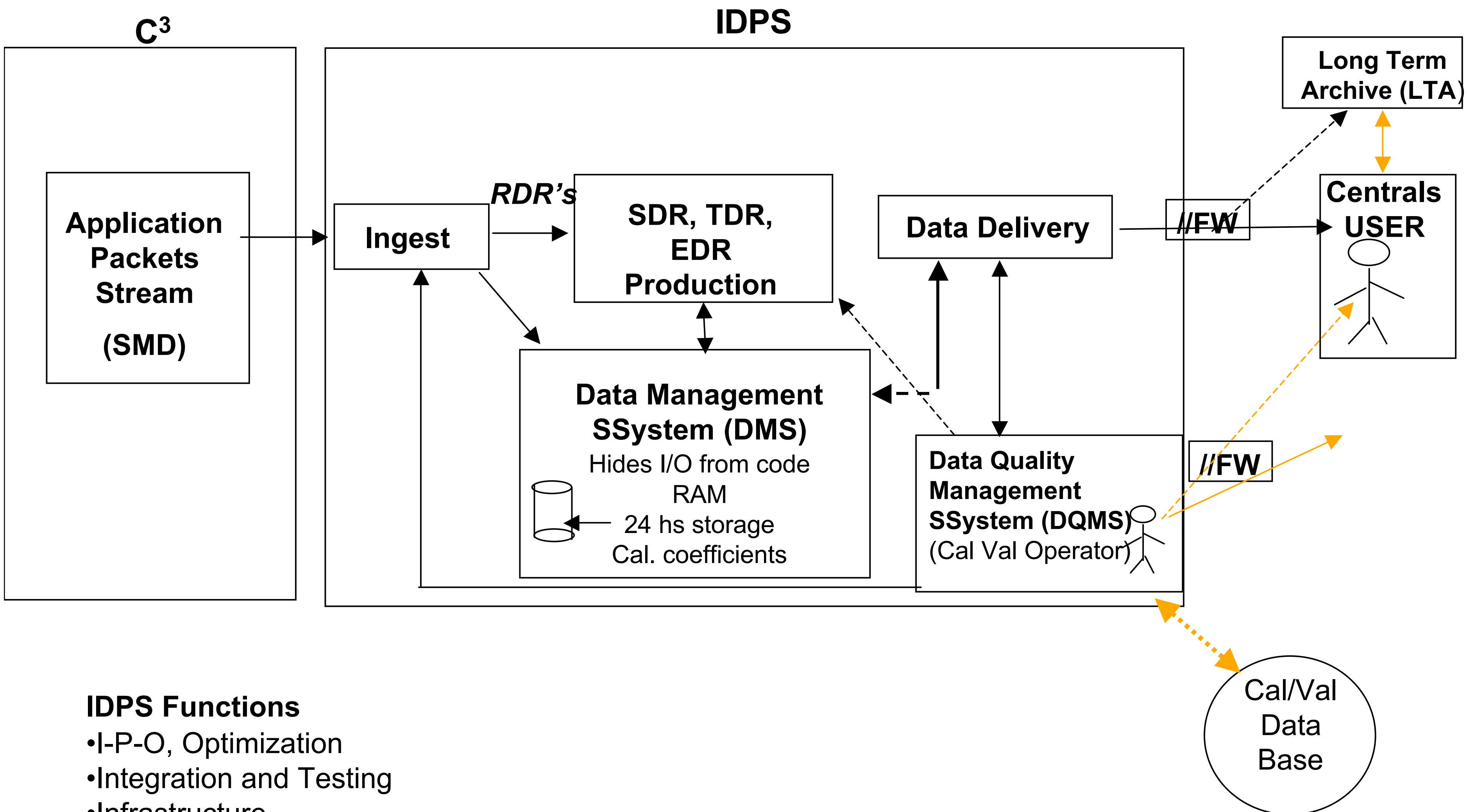
NGST Algorithm Lifecycle



Data Products Processing and Dissemination Flow



Data Processing Lifecycle (schematic)



IDPS Functions
- I-P-O, Optimization
- Integration and Testing
- Infrastructure
- Storage
- Data Management System
- Data Quality Management

Being refined

ERBS algorithms characteristics

- Modified and updated current CERES algorithms
  - 4 EDR's
    - Net Solar Radiation (TOA)
    - Outgoing Longwave Radiation (TOA)
    - Downward Longwave Radiation (Surface)
    - Downward Shortwave Radiation (Surface)
  - Surface albedo (potential IP)
    - Calculated over 15km ERBS footprint could bound high resolution VIIRS surface albedo product
  - Inputs for EDR processing: VIIRS visible (short wave calibration, aerosol optical depth retrievals, cloud properties); Meteorological Ozone and Aerosol data, Microwave Humidity – (1330 orbit)
- Sci – Ops:
  - Estimate of ~24K lines of new code; ~523K lines of reuse code

ERBS System Specifications

Parameter	Net Solar Radiation (Top of Atmosphere)	Outgoing Longwave Radiation (Top of Atmosphere)	Downward Longwave Radiation (Surface)	Downward Shortwave Radiation (Surface)
	Thresholds	Thresholds	Thresholds	Thresholds
Horizontal Cell Size	25 km	25 km	25 km at nadir	25 km
Horizontal Reporting Interval	HCS	HCS	HCS	HCS
Horizontal Coverage	Global	Global	Global	Global
Measurement Range	0 – 1400 W/m^2	0 – 500 W/m^2	0 - 500 W/m^2	0 - 1400 W/m^2
Measurement Accuracy	3 W/m^2	5 W/m^2	10 W/m^2 (TBR)	10 W/m^2
Measurement Precision	15 W/m^2	12 W/m^2	20 W/m^2	20 W/m^2
Mapping Uncertainty (MU)	5 km	5 km	5 km	5 km
Maximum Local Average Revisit Time	24 hrs	12 hours (once/daytime & once/ nighttime)	14 hrs	24 hrs
Latency	150 minutes	150 minutes	150 minutes	150 minutes
Long Term Stability	0.2 W/m^2	0.2 W/m^2	0.5 W/m^2	0.5 W/m^2

Processing Trade Evaluation Criteria

- Cost
- Schedule
  - IDPS need date for NPOESS
- Quality
  - Various measurement attributes including: precision, accuracy, uncertainty, spatial/temporal resolution and reliability
  - Dependence on NPOESS auxiliary data (VIIRS; OMPS?…) and NPOESS metadata
- System Timeliness
  - Time span between sensor observation and the corresponding EDR production and availability to the user by the ground segments.
  - ERBS user requirements vs NPOESS system specs (150 minutes)
- Processing Latency
  - IDPS algorithm requirements for timeliness
- NPOESS IDPS software requirements
  - interoperability, formats, coding standards, NPOESS geolocation/gridding; granule size…
  - impacts cost and schedule
- Other: potential use of ERBS EDR's for other sensor EDR's (e.g. albedo)
  - Impacts potential relaxation of latency requirements

Processing Trade off Options

- Assumptions
  - ERBS science grade code is strongly leveraged by current CERES algorithms.
  - ERBS Science grade EDR algorithms will be a modification/update from current CERES algorithms provided by LaRc

- Options
  1. All conversion at IDPS (sci to ops, I&T, infrastructure, storage and data delivery)
     a. Science grade code hosted at NGST for verification and testing
     b. Science grade code verification and testing at LaRc
  2. Subcontract to LaRc for part or all of the conversion to IDPS
     a. Verification and testing of science grade code and complete Sci to Ops conversion at LaRc (includes integration, infrastructure and DMS)
     b. Verification and testing of science grade code and I-P-O at LRc, Integration, infrastructure and DMS at IDPS
  3. All conversion at LaRc: skips Factory and Centrals IDPS except in 3b
     a. Data Delivery through C^3 to Users (uses security line, fw)
     b. Data Delivery through C^3 to IDPS to Users (uses 24 hs storage; accounting, etc).
     c. Data Delivery directly from LaRc to Users

Options Schematic

Option 1.

1a	NGST hosts algorithm Tests and Verifies W1 and W2 →	IDPS Sci-Ops (I-P-O, infrastructure, test and integration, DMA, DQMA →	Centrals IDPS Delivers data →	Centrals/USERS
1b	LaRc Tests and Verifies W1 and W2 →	IDPS Sci-Ops (I-P-O, infrastructure, test and integration, DMA, DQMA →	Centrals IDPS Delivers data →	Centrals/USERS

Option 2

2a	LaRc Tests and Verifies W1 and W2 →	LaRc Sci-Ops (I-P-O, infrastructure, test and integration, DMA, DQMA →	Centrals IDPS Delivers data →	Centrals/USERS
2b	LaRcTests and Verifies W1 and W2 Provides Sci to Ops I-P-O (32%) →	IDPS provides infrastructure, test and integration, DMA, DQMA (68%) →	Centrals IDPS Delivers data →	Centrals/USERS

Option 3

LaRc Tests and Verifies W1 and W2;
Provides Sci-Ops
Delivers data

C^3

IDPS

Centrals/USERS

Current Status

- Collect and evaluate inputs
  - ERBS Users
  - Code status
    - Code modifications, updates, testing requirements
    - Confirm total number of lines of code: new and reuse
    - Bandwidth requirements
    - Infrastructure and storage requirements
    - Cal/val requirements
  - Confirm auxiliary and ancillary data inputs requirements
  - Potential for relaxation of latency and availability requirements:
    - Latency specs. Vs users requirements
    - Quality and timeliness specs. Vs users requirements
  - Estimate/collect costs
- Evaluate costs vs data quality and timeliness and schedule
- “Completion depends on input collection timeframe: NGST SP requests ERBS OAT feedback, inputs”

Back up Slides

NORTHROP GRUMMAN
Space Technology
Raytheon

Algorithm Roles and Responsibilities

TASK/PHASE		SSPR TEAM										GOVERNMENT		
		SE&I IPT				IDPS IPT	P/L IPT	ST&E IPT	SAB	Suppliers		IPO	GCVT/ OOAT	User
		AIPL	SPT	ST	MSS					SV	AV			
Pre-Launch	Sensor and Operating Environment Characterization	S	-	P	L,P	-	P	-	A	P	P	A	A	-
	Science Algorithm Development/Procurement	S	-	P	-	-	L	-	A	L	P (L)	A	A	A
	Science Algorithm Verification	S	L	P	P	-	-	-	A	P	P	A	A	A
	Science to Operational Algorithm Migration	S	A	A	A	L	-	-	A	-	P	A	A	A
	Operational Algorithm Performance Verification	S	-	-	P	P	-	L	-	-	-	A	-	-
	Operational Algorithm Calibration/Validation	S	-	P	P	P	-	L	A	-	-	A	A,I	A
	Operational Algorithm Field Assessment	S	-	A	-	A	-	A	A	-	A	A	A	L,P
	Science or Operational Algorithm Rework	S	A	L	P	P	P	-	A	P	P	A	A	A
Early Orbit	Operational Algorithm Calibration/Validation	S	-	P	P	P	-	L	A	-	-	A	A,I	A
	Science or Operational Algorithm Rework	S	A	L	P	P	P	-	A	P	P	A	A	A
Operational	Sensor and Operating Environment Characterization	S	-	P	L,P	-	P	-	A	P	P	A	A	-
	Science Algorithm Development/Procurement	S	-	L,P	-	-	-	-	A	-	P (L)	A	A	A
	Science Algorithm Verification	S	L	P	P	-	-	-	A	P	P	A	A	A
	Science to Operational Algorithm Migration	S	A	A	A	L	-	-	A	-	P	A	A	A
	Operational Algorithm Performance Verification	S	-	-	P	P	-	L	-	-	-	A	-	-
	Operational Algorithm Calibration/Validation	S	-	P	P	P	-	L	A	-	-	A	A,I	A
	Operational Algorithm Field Assessment	S	-	A	-	A	-	A	A	-	A	A	A	L,P
	Science or Operational Algorithm Rework	S	A	L	P	P	P	-	A	P	P	A	A	A

Legend:

AIPL - Algorithm Implemention Process Lead
SPT - System Performance Team
ST - Science Team
MSS - Mission System Simulator (incl. IWPTB)
SE&I - System Engineering & Integration IPT
ST&E - System Test & Evaluation IPT
SAB - Science Advisory Board
P/L - Payload IPT
IDPS - IDPS IPT
IPO - Integrated Program Office (USG)
OOAT - Overarching Operational Algorithm Team
GCVT Government Cal/Val Team
User - IDPS Central or Field Terminal User
SV - Sensor Vendor
AV - Algorithm Vendor

S- Steward
L- Task Lead
P- Performance Support
A- Advisory
I- Independent V&V

Useful Algorithm Information on E-Rooms

This list is not meant to be exhaustive. It points to some of the key documents to make "searching" easier. It also provides a POC.

- **Top-Level Algorithm Processes & Responsibilities**
  - Data Product Algorithm Management (DPAM) Plan - (SE&I, Emch)
    - https://collab1.trw.com/eRoom/NPOESS/SystemEngineeringIntegration/0_2a3c3
  - Algorithm Roles & Responsibilities Matrix – (SE, Hughes)
    - https://collab1.trw.com/eRoom/NPOESS/SystemEngineering/0_c570

- **Cal/Val**
  - Sensor-Specific Cal/Val Plans - (ST&E, Lottman)
    - https://collab1.trw.com/eRoom/NPOESS/SystemTestEvaluation/0_24489

- **Science Algorithm Verification - Plans**
  - NPP EDR Science Algorithm Verification Plan (Overview) – (SE, Hughes)
    - https://collab1.trw.com/eRoom/NPOESS/SystemEngineering/0_b705
  - NPP EDR Latency Verification Plan – (SE, Shannon)
    - https://collab1.trw.com/eRoom/NPOESS/SystemEngineering/0_c58b
  - Sensor Characterization Tasks data package – (SE, Hughes)
    - https://collab1.trw.com/eRoom/NPOESS/SystemEngineering/ 0_b705

ERBS Auxiliary Data